HYDROMETRIC MONITORING

STRATEGY

Prepared by:
Prairie Provinces Water Board
Committee on Hydrology

JUNE 1994
PPWB Report No. 127

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Hydrometric Monitoring Strategy

Environment Canada has indicated that because of budget restraint it was becoming difficult to maintain the existing level of monitoring. The Prairie Provinces Water Board, at their April 1993 meeting, discussed the topic of water quantity networks for monitoring apportionment of interprovincial streams. The Board agreed that for the purpose of increasing efficiencies of the monitoring networks, the Committee on Hydrology should develop a strategy for determining appropriate hydrometric networks required for monitoring the apportionment of interprovincial streams. The principles described in this discussion paper will be used to assess the existing monitoring networks and to develop new monitoring networks for apportionment.

Cooperation

The primary role of the Board is to ensure that the 1969 Master Agreement on Apportionment is administered in an equitable manner. This requires that both streamflow and water use in eastward flowing streams be adequately monitored to enable the Board to either certify that apportionment of flow is achieved or to take steps within the year to achieve apportionment.

A founding principle in administering the 1969 Master Agreement on Apportionment is that of fostering continued cooperation so that the individual aims and desires of each province and of Canada may be realized. Accordingly, the underlying elements of mutual agreement and open discussion, which are necessary for a cooperative approach, must continue to be a primary consideration in assessing and developing monitoring networks for apportionment.

Monitoring Responsibility

Responsibility for the monitoring of water quantity and quality is addressed through the terms of the 1969 Master Agreement on Apportionment.

Clause 7 of the Master Agreement states:

> "... The parties agree that the monitoring of the quantity and quality of waters as specified in the First and Second Agreements, the collection, compilation and publication of water quantity and quality data required for the implementation and maintenance of the provisions of this agreement shall be conducted by Canada, subject to provision of funds being voted by the Parliament of Canada."

It is clear from Clause 7 of the 1969 Master Agreement on Apportionment that Canada has the responsibility for collection, compilation and publication of water quantity and quality data required for the implementation and maintenance of the provisions of the 1969 Master Agreement on Apportionment. This responsibility includes providing the funds and other resource requirements necessary to carry out the monitoring.

Although the monitoring requirements under Clause 7 are determined by the Prairie Provinces Water Board (PPWB), the water quantity and quality monitoring is carried out for Canada by Environment Canada (DOE), Prairie and Northern Region.

Monitoring Requirements

There are over one hundred hydrometric gauging stations in the prairie provinces where records are used to calculate natural flow for apportionment purposes under the 1969 Master Agreement on Apportionment. The gauging stations are categorized as:

1. sites from which the streamflow and water level data is used to calculate natural flow for interprovincial apportionment purposes, and

2. sites that are required for monitoring purposes as part of Canada's international commitment as well as being needed to estimate the balance of flow for interprovincial purposes.

In addition, the Board has identified a number of sites which are used to support interprovincial water management but are not required to calculate natural flow for apportionment.

Information for basins being apportioned or considered for apportionment are shown in Tables 1 and 2. Table 1 provides a summary of relevant information for apportioned interprovincial streams. Table 2 provides a summary of relevant information for each of the twenty small interprovincial streams where natural flow studies have been conducted for the Board.

Apportionment Monitoring Guidelines

The report "Apportionment Monitoring of Small Interprovincial Streams", PPWB Report #122 (April, 1993), provided a strategy for alerting the Board of potential apportionment problems and for notifying the Board when monitoring is required. However, the report did not specify criteria for making this determination or for assessing the extent of the monitoring effort.

Upon review of this matter, the Committee on Hydrology recommends the following criteria for these small interprovincial streams:

1. Apportionment monitoring should commence in an eastward flowing stream basin when the present level of use exceeds 25% of the annual natural flow in a

moderate drought year[1], or basin residents perceive an apportionment problem. The basic network used to determine apportionment should monitor annual flow at the boundary, and diversions and consumptive uses which exceed 10% of the annual natural flow in a moderate drought year. Diversions less than 10% of the annual natural flow in a moderate drought year are considered minor and can be estimated.

2. An advanced network is required to determine apportionment when the level of use in the upstream province exceeds 90% of its entitlement in a moderate drought year. The monitoring network should include a boundary site, and all diversions and consumptive uses which exceed 5% of the annual natural flow in a moderate drought year. Diversions or uses less than 5% of the annual natural flow in a moderate drought year are considered minor and can be estimated.

The Committee on Hydrology recognized that the above general criteria can only be applied to the small basins currently not apportioned. However, for the major interprovincial streams, special management conditions have been built into the apportionment procedures to ensure minimum flow conditions and to cover equitable interprovincial water management needs. Accordingly, the Committee on Hydrology concludes that a detailed analysis of the networks for these major basins must be conducted to determine the appropriate monitoring network for apportionment.

Conclusions

The Committee on Hydrology concludes that:

[1] A moderate drought year is defined as a year having a one in ten low flow or the annual flow which will be exceeded 90% of the time.

1. the individual aims and desires of each province and of Canada can best be realised through a cooperative approach;

2. under Clause 7, Environment Canada is responsible for undertaking the monitoring as determined by the Prairie Provinces Water Board;

3. the criteria developed for establishing apportionment monitoring network need only be applied to streams that have not yet been apportioned; and

4. basins already apportioned often include minimum flow conditions or interprovincial water management conditions and can only be evaluated on an individual basin basis.

Recommendations

The Committee on Hydrology recommends that:

1. the guidelines for initiating and designing apportionment monitoring networks in small interprovincial basins be tested by the Committee on Hydrology; and

2. appropriate apportionment networks be determined for the South Saskatchewan River and Qu'Appelle River basins, respectively which consider the special interprovincial management conditions.

3. the apportionment network analysis for the South Saskatchewan River basin be conducted by Alberta Environmental Protection and for the Qu'Appelle River basin be conducted by Sask Water.

TABLE 1

A SUMMARY FOR APPORTIONED INTERPROVINCIAL STREAMS

BASIN	(1) MEAN ANNUAL NATURAL FLOW (DAM^3)	(2) MEAN ANNUAL RECORDED FLOW AT BOUNDARY (DAM^3)	(3) MEAN ANNUAL WATER USE AT PRESENT USE LEVEL (DAM^3)	(4) PRESENT LEVEL OF WATER USE AS % OF NATURAL FLOW	(5) MEAN ANNUAL SURPLUS (DAM^3)	(6) NUMBER OF DEFICIT YEARS AT PRESENT USE LEVEL	(7) PERIOD CON-SIDERED	(8) NUMBER OF MONITOR-ING STATIONS
SOUTH SASKATCHEWAN RIVER	8 552 000	6 796 000	1 756 000	20.5	2 520 000	0	1967-92	56-(E)
CHURCHILL RIVER	22 256 000	21 965 000	291 000	1.3	10 837 000	0	1929-30 1992-93	3-(E)
NORTH SASKATCHEWAN RIVER	6 918 000	6 769 000	149 000	2.2	3 310 000	0	1970-92	3-(E)
QU'APPELLE RIVER	147 000	218 000	23 000	15.6	144 000	0	1975-76 1992-93	22-(E)
SASKATCHEWAN RIVER	15 837 000	15 134 000	703 000	4.4	7 215 000	0	1977-78 1992-93	9-(E)
BATTLE CREEK	7 600	7 400	200	2.6	1 700	0	1985-92	2-(E)
LODGE CREEK	16 000	14 300	1 700	10.6	2 300	3	1985-92	7-(E)
MIDDLE CREEK	4 200	3 650	550	13.0	500	2	1985-92	2-(E)

(E) - EXISTING MONITORING STATION
(P) - PROPOSED MONITORING STATION

TABLE 2
A SUMMARY OF APPORTIONMENT ANALYSIS FOR SELECTED SMALL INTERPROVINCIAL STREAMS

BASIN	(1) MEAN ANNUAL NATURAL FLOW (DAM^3)	(2) MEAN ANNUAL WATER USE AT PRESENT USE LEVEL (DAM^3)	(3) PRESENT LEVEL OF WATER USE AS % OF NATURAL FLOW	(4) MEAN ANNUAL SURPLUS (DAM^3)	(5) NUMBER OF DEFICIT YEARS AT PRESENT USE LEVEL	(6) PERIOD CON-SIDERED	(7) NUMBER OF MONITORING STATIONS REQUIRED
BOXELDER CREEK (H)	17 707	9 624	54.3	2 095	43	1912-88	1-(E)
PIPESTONE CREEK (H)	33 833	-128 **	0	17 124	2	1912-13 1988-89	3-(E)
ANTLER RIVER (M)	20 851	2 020	9.7	9 278	11	1912-13 1986-87	1-(E) 2-(P)
BEAVER RIVER (M)	623 071	16 070	2.6	295 465	0	1912-88	1-(E)
GAINSBOROUGH CREEK (M)	8 225	614	7.5	3 530	22	1912-13 1987-88	1-(E) 1-(P)
GRAHAM CREEK (M)	751	49	6.5	339	3	1912-13 1987-88	1-(P)
JACKSON CREEK (M)	1 093	108	10.0	490	30	1912-13 1987-88	1-(P)
STONY CREEK (M)	973	85	8.8	425	25	1912-13 1987-88	1-(P)
ASSINIBOINE RIVER (L)	283 753	8 057	2.8	133 849	0	1912-13 1987-88	6-(E)
BATTLE RIVER (L)	285 944	24 628	8.6	118 785	0	1912-88	6-(E)
BIG GULLY CREEK (L)	2 773	26	0.9	1 360	0	1912-88	1-(P)
BIRCH RIVER (L)	30 539	-32 351 *	0	48 340	0	1936-37 1984-85	1-(P)
BOSSHILL CREEK (L)	521	0	0	261	0	1912-13 1987-88	1-(P)
ELM CREEK (L)	2 000	0	0	1 000	0	1936-37 1984-85	1-(P)
EYEHILL CREEK (L)	2 296	118	5.1	1 030	1	1912-88	1-(P)
GOPHER CREEK (L)	672	6	0.9	331	1	1912-13 1987-88	1-(P)
OVERFLOWING RIVER (L)	169 235	5 135	3.0	79 581	0	1912-13 1985-86	1-(P)
RED DEER RIVER (SASK.) (L)	592 477	-45 409 ***	0	341 648	0	1912-13 1985-86	1-(E)
SWAN RIVER (L)	184 083	116	.06	91 926	0	1912-13 1982-83	1-(P)
WOODY RIVER (L)	51 871	0	0	25 935	0	1912-13 1987-88	1-(P)

(E) - EXISTING MONITORING STATION
(P) - PROPOSED MONITORING STATION
(H) - HIGH POTENTIAL FOR APPORTIONMENT
(M) - MEDIUM POTENTIAL FOR APPORTIONMENT
(L) - LOW POTENTIAL FOR APPORTIONMENT
* - INCLUDES INFLOW FROM SASKATCHEWAN RIVER
** - INCLUDES KIPLING MARSH PUMPED DRAINAGE
*** - INCLUDES CONTRIBUTION FROM DRAINAGE PROJECTSc: